CLAIMS

<u>What is Claimed is</u>:

1. An apparatus for providing power to a power dissipating device, comprising:

a first circuit board having a power conditioner circuit, the first circuit board having a first side and a second side having a plurality of first circuit board contacts thereon, the first circuit board contacts including a first set of first circuit board contacts communicatively coupled to a first power conditioner circuit connector and a second set of first circuit board contacts communicatively coupled to a second power conditioning circuit connector;

a second circuit board having:

the power dissipating device mounted thereto;

a plurality of second circuit board contacts disposed on a first side of the second circuit board, the second circuit board contacts including a first set of second circuit board contacts communicatively coupled to a power dissipating device first connector and a second set of second circuit board contacts communicatively coupled to a second connector of the power dissipating device;

a plurality of z-axis compliant conductors disposed at least partially between the first circuit board contacts and the second circuit board contacts; and

wherein the plurality of z-axis compliant conductors includes a first set of z-axis compliant conductors in contact with and disposed between the first set of first circuit board contacts and the first set of second circuit board contacts, and a second set of z-axis compliant conductors disposed in contact with and between the second set of first circuit board contacts and the second set of second circuit board contacts, and

wherein the first set of first circuit board contacts, the first set of z-axis compliant conductors, and the first set of second circuit board contacts define a plurality of first paths from the first circuit board to the second circuit board and wherein the second set of circuit board contacts, the second set of z-axis compliant conductors, and the second set of second circuit board contacts define a plurality of second paths from the first circuit board to the second circuit board.

2. The apparatus of claim 1, wherein the plurality of first paths and the plurality of second paths together provide a low impedance power path from the first circuit board to the second circuit board.

3. The apparatus of claim 2, wherein at least of the z-axis compliant conductors comprises a slit forming a first current path and a second current path through a substantial portion of a length of the conductor, thereby reducing the inductance of the low impedance power path from the first circuit board to the second circuit board.

4. The apparatus of claim 1, wherein the number of first circuit paths and second circuit paths and a distance between the first circuit board and the second circuit board is selected to provide an aggregate circuit path impedance of less than approximately 100 pico-henries.

5. The apparatus of claim 1, wherein the plurality of first paths are ground paths and the plurality of second paths are power paths.

6. The apparatus of claim 5, wherein:

the plurality of ground paths are interleaved with the plurality of power paths.

7. The apparatus of claim 1, wherein the plurality of first paths are positive polarity paths and the plurality of second paths are negative polarity paths.

8. The apparatus of claim 7, wherein the plurality of positive polarity paths are interleaved with the plurality of negative polarity paths.

9. The apparatus of claim 1, wherein the plurality of z-axis compliant conductors are disposed adjacent more than one side of the power dissipating device.

10. The apparatus of claim 9, wherein:

the z-axis compliant conductors are at least partially contained within a socket mounted to the first circuit board.

11. The apparatus of claim 9, wherein:

the power dissipating device comprises a plurality of sides;

the power conditioner circuit provides power output signal having a plurality of phases, each phase at one of the sides of the power dissipating device.

12. The apparatus of claim 1, wherein:

the plurality of first circuit board contacts comprises a first subset of first circuit board contacts and a second set of first circuit board contacts;

the plurality of second circuit board contacts comprises a first subset of second circuit board contacts and a second set of second circuit board contacts;

the first set of z-axis compliant conductors comprises a first subset of first set of z-axis compliant conductors and a second subset of the first set of z-axis compliant conductors;

the second set of z-axis compliant conductors comprises a first subset of the second set of z-axis compliant conductors and a second subset of the second set of z-axis compliant conductors;

the first subset of first circuit board contacts, the first subset of the second circuit board contacts, the first subset of the first set of z-axis compliant conductors, and the first subset of the second set of z-axis compliant conductors are disposed circumferentially around the power dissipating device; and

the second subset of first circuit board contacts, the second subset of the second circuit board contacts, the second subset of the first set of z-axis compliant conductors and the second subset of the second set of z-axis compliant conductors are disposed circumferentially around the first subset of first circuit board contacts, the first subset of the second circuit board contacts, the first subset of the first set of z-axis compliant conductors, and the first subset of the second set of z-axis compliant conductors, respectively.

13. The apparatus of claim 1, wherein:

the first side of the second circuit board is an edge of the first circuit board

the plurality of z-axis compliant conductors are disposed circumferentially about the second circuit board.

14. The apparatus of claim 1, wherein the plurality of z-axis compliant conductors are permanently attached to the plurality of first circuit board contacts or the plurality of second circuit board contacts.

15. The apparatus of claim 1, wherein the first circuit board is detachable from the second circuit board.

16. The apparatus of claim 1, wherein at least one of the plurality of first paths and the plurality of second paths is a power control path or a signal path.

17. The apparatus of claim 1, wherein at least one of the z-axis compliant conductors comprises a cantilevered beam.

18. The apparatus of claim 1, wherein at least one of the z-axis compliant conductors is U-shaped.

19. The apparatus of claim 1, wherein:

at least one z-axis compliant conductor comprises a base portion contacting one of the first circuit board contacts and an interface portion contacting one of the second circuit board contacts; and

the interface portion is disposed substantially along the only the z-axis from the base portion, thereby reducing torsional force on the base portion.

20. The apparatus of claim 1, wherein:

the first set of z-axis compliant conductors are removably in contact with the first set of first circuit board contacts and the first set of second circuit board contacts;

the second set of z-axis compliant conductors are removably in contact with the second set of first circuit board contacts and the second set of second circuit board contacts; and

the apparatus further comprises an insulating overmold disposed around at least a portion of the z-axis compliant conductors and between the first circuit board and the second circuit board, the overmold retaining the first set of z-axis compliant conductors in contact with and disposed between the first set of first circuit board contacts and the first set of second circuit board contacts, and a second set of z-axis compliant conductors disposed in contact with and between the second set of first circuit board contacts and the second set of second circuit board contacts.

21. The apparatus of claim 1, wherein at least one of the z-axis compliant conductors comprises:

a base portion having a first end and a second end distal from the first end;

a first U-shaped bend portion having a first end adjacent the second end of the base portion and a second end;

a upper shaft portion having a first end adjacent the second end of the first U-shaped bend portion and a second end distal from the first end;

a second U-shaped bend portion having a first end adjacent the second end of the upper shaft portion and a second end; and

a middle shaft portion, disposed between the base portion and the upper shaft portion, the third shaft portion having a first end adjacent the second end of the second U-shaped bend portion and a second end distal from the third end.

22. The apparatus of claim 21, further comprising a bend portion having a first end disposed adjacent the second end of the third shaft portion and a second end distal from the first end and directed toward the second shaft portion.

23. The apparatus of claim 1, wherein at least one of the z-axis compliant conductors comprises a contiguous elongated conductor folded into a compliant paper-clip shape.

24. The apparatus of claim 1, wherein at least one of the z-axis compliant conductors comprises a continuous elongated conductor folded into a base portion, an upper shaft portion, and a middle shaft portion between the base portion and the upper shaft portion.

25. The apparatus of claim 21 or 24, wherein the base portion has a first side affixed to the second circuit board, the upper shaft portion is disposed adjacent to the first circuit board, and the middle shaft portion contacts a second side of the base portion opposite the first side of the base portion, thereby forming a first conductive path through the upper shaft portion to the base and a second conductive path through the middle shaft portion to the base.

26. The apparatus of claim 1, wherein the power conditioning circuit further comprises:

a capacitive element disposed on the first side of the first circuit board and at a location opposite at least one of the first circuit board contacts on the second side of the first circuit board.

27. The apparatus of claim 26, wherein the capacitive element comprises a first connector communicatively coupled to the at least one of the first circuit board contacts, and a second connector communicatively coupled to another first circuit board contact adjacent the at least one of the first circuit board contacts.

28. The apparatus of claim 26, wherein

the capacitive element comprises a first connector communicatively coupled to the at least one of the first circuit board contacts;

the capacitive element comprises a second connector communicatively coupled to another first circuit board contact; and

wherein the at least one of the first circuit board contacts is a power contact and the another first circuit board contact is a ground contact.

29. The apparatus of claim 26, wherein

the capacitive element comprises a first connector communicatively coupled to the at least one of the first circuit board contacts;

the capacitive element comprises a second connector communicatively coupled to another first circuit board contact; and

wherein the at least one of the first circuit board contacts is a positive polarity contact and the another first circuit board contact is a negative polarity contact.

30. The apparatus of claim 1, wherein the first set of z-axis compliant conductors are oriented in a first direction, and the second set of z-axis compliant conductors are oriented in a second direction rotated 180 degrees from the first direction.

31. The apparatus of claim 1, wherein:

the z-axis compliant conductors each comprise a base and an interface portion disposed away from the base along the z-axis; and

the interface portion of each of the first set of z-axis compliant conductors together define a first row of z-axis compliant conductors and the interface portion of each of the second set of z-axis compliant conductors together define a second row of z-axis compliant conductors displaced from the first row of z-axis compliant conductors along the x or y axis.

32. The apparatus of claim 30 or 31, wherein the first set of second circuit board contacts form a first continuous conductive surface for electrically communicating with the first set of z-axis compliant conductors and the second set of circuit board contacts form a second contiguous conductive surface for electrically communicating with the second set of z-axis compliant conductors.

33. The apparatus of claim 30 or 31, wherein the first set of second circuit board contacts form a first continuous conductive surface for electrically communicating with the first set of z-axis compliant conductors and the second set of circuit board contacts form a second contiguous conductive surface for electrically communicating with the second set of z-axis compliant conductors, thereby providing a tolerance for misalignment of the z-axis compliant conductors.

34. The apparatus of claim 1, wherein:

the first set of first circuit board contacts includes a first subset of first circuit board contacts and a second subset of first circuit board contacts; and

the first set of z-axis compliant conductors comprises a contiguous elongated conductor having a base portion communicatively coupled to one of the first subset of first circuit board contacts, a cantilevered beam portion communicatively coupled to one of the first set of second circuit board contacts, and a wrap-around portion communicatively coupled to one of the second subset of first circuit board contacts.

35. The apparatus of claim 34, wherein:

the contiguous elongated conductor base portion is soldered to the one of the first subset of first circuit board contacts; and

the cantilevered beam portion is removably communicatively coupled to the one of the first set of second circuit board contacts and the wrap-around portion is removably communicatively coupled to the one of the second subset of first circuit board contacts.

36. The apparatus of claim 1, wherein each of the z-axis compliant conductors is held in place between the first circuit board and the second circuit board by a frame about at least a portion of the periphery of the power dissipating device.

37. The method of claim 1, wherein:

the power dissipating device comprises a plurality of signal connectors, the plurality of signal connectors communicatively coupled to a plurality of signal pins disposed on a second side of the second circuit board by a plurality of signal vias disposed at least partially through the second circuit board and by conductive signal layers disposed within the second circuit board;

wherein the first set of second circuit board contacts is communicatively coupled to the power dissipating device first connector by a first conductive layer and one or more vias, and the second set of circuit board contacts is coupled to the power dissipating device second connector by a second conductive layer and one or more vias; and

wherein the first conductive layer and the second conductive layer are disposed on a power dissipating device side of substantially all of the conductive signal layers, thereby substantially minimizing the passage of power through signal interconnect planes.